Middle Rio Grande Endangered Species Act Collaborative Program
Habitat Restoration Subcommittee Forum

June 23, 2005 – 9:00 a.m. – 4:00 p.m.
NM ES Office, FWS, 2105 Osuna Rd. NE, Albuquerque, NM

Welcome and Introductions

- The HRS co-chairs, Kathy Dickinson and Matt Schmader, welcomed participants to the forum.
- Gina DelloRusso provided a forum introduction and reviewed the agenda.
- Matt Schmader served as the forum's mediator with assistance from Kathy Dickinson, Julie Hall, and Nancy Baczek.

Presentation 1: Rio Grande Silvery Minnow Life History and Aquatic Environment
Panel lead and presenter: Jen Parody – FWS NMES Office, Panelists: Jason Remshardt - FWS Fisheries Resource Office, Hugo Magana – UNM, and Cyndie Abeyta – FWS NMES Office, with contributions from David Cowley – NMSU.

Updates on the RGSM Population Estimates

- Currently there are no estimates of population size. There is a great deal of debate on how many minnows there are in the river.
- Surrogates are currently used to determine the status of populations. These include:

  1) Catch per unit effort, (CPUE)
     - This looks at the density of RGSM in a particular area on a capture (e.g., per seine net haul) basis.
     - It is most commonly used to assess trends over time

  2) Relative Abundance
     - This is a type of community measurement. It determines how many minnows are there relative to other species
     - Platania's data generally indicates that RGSM, relative to other undesirable species, are declining. Over the past 10 years, proportions of red shiners within the catches have increased and RGSM have decreased.

  3) Distribution
     - Distribution is used largely for recovery
     - It looks at where the fish are in the river.
     - Currently, the distribution is down to about 5% of the historic range (e.g., between Cochiti and Elephant Butte reservoir).
     - When considering recovery of the species, it relates to how much of the historic range of the RGSM can be repopulated, among other considerations.
- RGSM catch rates (as shown on slide 3) indicate that there has been a fairly significant drop in captured numbers to 2003. There has been a slight increase in captured numbers from 2003 to 2004.

- There has been a notable shift in the RGSM populations in the MRG to the north based on CPUE data (RGSM/100m^2) from 1999 to 2004. There are now more RGSM in the Albuquerque (Angostura) Reach than the San Acacia Reach.
    - One explanation for this shift is augmentation.

Augmentation

- There have been releases of fish bred in captivity in the MRG since 2000. Releases have taken a more systematic approach since 2002. Approximately 300,000 RGSM have been released in the Angostura reach, primarily at the Alameda and Highway 550 Bridges. Since 2002, some also have been continuously released by boat throughout the reach.
- Because of the shift of RGSM distribution to the north, the FWS is considering augmenting the populations downstream of the San Acacia Diversion Dam (SADD).
    - The release could help to repopulate a reach that historically had a relatively abundant population
    - Such releases could also be used to help document fish movement – placing fish upstream and downstream of SADD.
    - Measuring retention and survival would also be possible.
- Currently waiting to see the outcome of distribution for this year prior to finalizing plans.

Updates on RGSM Movement and Fish Passage

- The 2003 Biological Opinion (BO) requires that fish passage be provided for San Acacia by 2008. The reason, in part, is to reconnect the reaches and subpopulations.
- In the BO, Reclamation is tasked with determining how fish move and what the barriers are for fish passage. A number of studies on swimming performance, fish movements, and barriers to fish passage have been funded. Additional Program funds to continue alternative design development have been requested.
- Things we know about fish movement but can't necessarily quantify are;
    - RGSM are strong swimmers
    - RGSM move/respond to flow – They tend to avoid higher flow velocities with swirling water
- How/If/When the RGSM moves upstream in the river is a topic of great debate.
        - There is mounting evidence that the fish stays near augmentation sites -there is a huge number of fish near the Alameda Bridge
        - Limited data also indicate that RGSM can move great distances, both upstream and downstream
- Historical distribution data indicate that fish have been able to move upstream and downstream
    - Eggs drift downstream and historically there were fish throughout the MRG from the lower Rio Chama to near the Gulf of Mexico.
    - There has also been historic repopulation of previously dried reaches
- Reconnecting the subpopulations by reconnecting river reaches through irrigation diversions may have value; how much and how it will be done remains to be determined.

- Interconnection should benefit genetic diversity

Water Quality and Updates on Toxicity to Fish

- Water quality research: The FWS conducted a water quality study in 2002-2003, which encompassed a diversity of different variables:
  - Inputs to the system during different flow regimes:
    - Low Flows - When flows are low in standing pools – there is low dissolved oxygen and some minerals may precipitate out.
    - Average Flows – There is some data collected by the USGS
    - High Flows – Need to look at what happens to water quality (oxygen, nutrients, and organic acids) during over bank flooding
  - Inputs into the system influencing water quality change bulleting to match above:
    - Point sources - wastewater treatment plant outfalls
    - Nonpoint sources – There is currently a Bosque (tree) kill happening near Rio Rancho, it may be that a nonpoint source related to the shallow groundwater within that area has caused the tree kill
    - Fire – overbank flows occurring in areas where there are ashes on the ground
    - Past and recent pesticide use, chemical spills, and illegal dumping

Water Quality Concerns

1) Chemicals (need to assess water, sediments and fish tissues).
   - 2002-2003 FWS study indicated ammonia (water), chlorine (water), pesticides (water and fish tissue), PAHs (sediment), and low oxygen may be water quality issues.

2) Fish health - analysis indicated
   - Abnormalities/deformities
   - Low fat reserves
   - Disease/parasites

3) Flow Regime
   - Desiccation
   - Diversion
   - Canalization

4) Habitats
   - Nursery areas
   - Land use impacts
   - Riparian quality

5) Energy Factors
   - Nutrient cycles
   - Diet and food quality

6) Biological factors

- Diversity
- Abundance
- Competitors

- Toxicity studies – Cowley 2004 indicate
  - Studies involving incubation of RGSM eggs at different salinities indicated 4 parts per thousand (ppt) is lethal for 50% of RGSM embryos tested
  - 5% survival at 8 ppt
  - The salinity of the Rio Grande ranges between 0.1-11.2, 45% of the river is >0.2ppt and 5% of the river has measured at lethal levels.
- It is speculated that the shredding of saltcedar for use as mulch may contribute to high salinity levels in Bosque soil. (However Todd Caplan commented that his leaching studies of such material resulted in no salinity increases in the leachate.)

What promotes food resources for the RGSM?

- Algal growth is influenced by
  - Light
    - Turbidity
    - Depth
  - Water
    - Temperature
    - pH
  - Nutrients
  - Flow velocity

Predation and Competition

- It is suspected that the majority of predators on eggs/larvae and adult RGSM are found in impoundments (reservoirs). If eggs or the RGSM would make it to Elephant Butte Reservoir, they would be subject to predation
- It is also suspected that predators on both young and larvae – red shiner, mosquito fish, and fathead minnow - are promoted by changes in habitat. The relative abundance of red shiner, fathead minnow, and gambusia have increased while RGSM relative abundance has decreased.
- Low, stable flow conditions, i.e. summer low-flow and intermittency are good conditions for successful reproduction of these three fish. While there is no doubt of predation, this is just a secondary problem; the important fact is that these conditions favor these fish over RGSM and other fluvial fish such as flathead chub and longnose dace. It's not just predation, but overall competition for space.
- These predation and competition for habitat relationships to the RGSM needs more research to develop a clearer understanding of what is going on.

Genetics

- Current research on RGSM indicates a loss of genetic diversity over time.
- Historically there were 14 different subtypes in the wild; now there are only 10; at the hatchery, there were only 6 subtypes recorded.
- From a genetic perspective, there is concern that augmentation practices may swamp out the wild populations.
- There has been a shift in genetic diversity. In earlier studies, areas downstream in the San Acacia Reach had the most genetic diversity. In recent studies, the most diversity is found upstream in the Angostura Reach.
- The current estimate on how many minnows are needed to maintain diversity over time ranges from 400,000 minnow in the short term upwards to 4 million as a final target.

Refugia

- The BO requires 2 additional natural refugia (places where minnows bred and reared and are not susceptible to environmental stress) be established at different locations along the MRG.
- Several different refugia projects are ongoing
- The City's naturalized refugia project is a self contained system cut off from the river. Minnows are grown out through all the different life stages and most of the fish are augmented back into the river.
- There is also the minnow sanctuary project that the FWS, Reclamation, and MRGCD are developing that will utilize water from a riverside drain and move it through an area of the Bosque. This project will be semi naturalized and will have an outfall to the river. The area is intended to be used for grow out of smaller RGSM for augmentation back into the river. In the long-term this sanctuary may be utilized for all the different life stages of the RGSM. This project is anticipated to be operating by June 2006.
- The ISC is working on another refugia which will be a grow-out facility near Sile (near Santo Domingo). This project will have some refugia and grow out capabilities.

Follow-up Discussions

Jason Remshardt indicated that it is true that a lot of fish that were augmented into the river have been found near the areas they were released; but, the release areas were chosen because they were the areas where the most RGSM were collected, indicating that the release areas contain habitat that the RGSM prefers. RGSM were purposely stocked in areas where wild fish were found at high densities. Thus, we have a question, *Do the RGSM chosen to stay near the areas that they were released (augmented) because they do not move far or because they were released in areas with good habitat?*

When discussing habitat restoration it is important to mention that both red shiner and fathead minnow (non-fluvial specialists) do really well in low water years with relatively stable flows, especially in the Isleta reach. This is partly due to habitat, but it is also much related to the flow regime. So if the flows are manipulated, the different densities of the fish can also be manipulated. RGSM are just the opposite – they respond favorably to unstable flows.

Describe the habitat at the augmentation release sites.

The habitat was variable. The habitat had side channels, back water areas, different flows, islands, lots of diversity in aquatic habitat in general.

Is the habitat at the augmentation release sites bounded by a spatial extent; how big an area of habitat does the RGSM need?

It is really the Albuquerque Reach in general. If the fish are there in the summer, they are found in every habitat.

Hugo Magana mentions with respect to light penetration, the MRG is very turbid. Quantameter measurements at water depths of 100 and 170 mm are being done to see how much light is penetrating. There is a 50% decrease in light from 100 to 170 mm. Algae are only found in water at 10 cm depth or less.

Nutrients studied at northern sites, Bernalillo Bridge and Angostura Diversion Dam indicate that the nutrients and algal diversity are low. At the southern sites, Rio Bravo and Ashurt, there is an order of magnitude increase in nutrients and a 3x increase in the diversity of algae.

The typical pH of the river is about 8 until the waste water treatment plant outfall then it decreases to pH 7.

The RGSM eats a lot of algae – example: a 4 week old minnow consumes up to 2 Petri dishes covered in algae a day. It may be one of the reasons that the RGSM is in decline because there just may not be enough food out there and during high flows algae is washed out.

What time of year was the water quality sampling conducted?

The sampling was performed seasonally. The results indicate that there is seasonal variation. This data is anticipated to be published shortly. In general, there is a spike after the WWTP and a spike below Albuquerque.

Do you think there may be some food limitations within the system; have you characterized light attenuation or other characteristics in your system?

Light measurements have been made north to south. There is more light penetration at the northern sites, but there is less nutrients.

Relative to the algal community, you indicate that diatoms are part of the diet?

Diatoms are a part of the RGSM's diet. The analysis is an acid digestion process, to remove more materials, thus eliminates the soft greens, so diatoms skeletons are only being examined.

Some diatoms are heterotrophic and may not be light dependant. How much of the diet do you feel is light driven?

The diatoms that have been identified are definitely phototrophic. Light plays a major role.

Is light a more important factor for algae than the scouring flow?

We sampled after a high flow event and it essentially scoured away all of the algae. In that respect, flow is more important.

What features within a reach are important to maintain local populations with respect to a diverse hydrograph?

The main thing would be perpendicular arroyo-type habitats where there is deep water and shallow margins where algae can grow. This is what is being found at Los Lunas.

Where are all of your sites, in general?

Sites are located: between Angostura Diversion Dam and private property (420 m); south of Bernalillo Bridge (500 m), north of the WWTP (500m), Shirk site (500 meters north of the ET tower), and Los Lunas.

What is being done to potentially offset the loss of genetic heterogeneity during augmentations?

We are currently operating by set propagation protocols; they are the most conservative methods. The priorities for propagation are to collect wild eggs throughout the reaches and use the adults from the wild eggs to spawn and use those offspring for propagation. Throughout each process genetic samples are being taken. Every batch that goes out is monitored and compared to the wild population.

Can you keep track of batches of egg? Is there diversity within each batch?

A couple of different studies are looking at different breeding methods: group vs. paired mating at the hatchery. The data is not out yet. We are trying to collect as much wild material as possible.
More details about genetic issues were presented during the PAP presentations. Copies of the presentations can be found at http://www.fws.gov/mrgesacp/PAP.cfm

Is there anything that is known about the relative salinity tolerance of predatory fish vs. the RGSM?

This is nothing known off hand, data on predatory fishes are probably out there. The study results that were presented were on RGSM larvae. The salinity tolerance is not known about the adult RGSM itself. Salinity within the Albuquerque reach ranges from 0.1-0.2. Monthly salinity measurements for the Isleta and San Acacia reaches ranged from 0.1-0.6. Salinity is significantly lower in the spring.

It needs to be determined where and when the high salinity measurements were taken in Cowley's study.

Cyndie Abeyta mentions, in terms of extinction in general, body tissue, what the species is eating and breathing, soils, and food sources are all important factors. In terms of water quality, the bottom material and tissue are also important to examine. In 2002-2003 the FWS identified major concerns. During the FWS study, they also conducted a literature search which identified 86 reports. Only 1 or 2 of those reports integrated water column results with tissue and sediment information.

Patrick Sherring had done a gut content analysis of fish collected in the 1800's and the results indicated that there was a highly polluted river back then. The diatom community had changed considerably from the 1800's to the 1970's. It is possible the river has a much lower nutrient load than it did historically? This is an area that needs more work, since the study only analyzed three different fish.

What is the source for nutrients in the upper reaches?

The only source would be overbanking, bringing the nutrients back into the main channel.

On the topic of overbank flooding - one of the things that occurs and needs to be factored into habitat restoration is that the water can get in (overbank areas), but sometimes it can not get out. Restoration efforts need to incorporate ways for the water to get in and back out to the river, so the fish can get back to the river.

Presentation 2: Southwestern Willow Flycatcher (SWWF) Life History and Riparian Environment Panel lead: Rob Doster - Reclamation, Panelists: Nancy Baczek - FWS, Mark Sogge - USGS, Gail Garber – Hawks Aloft , Deb Finch – RMRS USFS, Darrell Ahlers and David Moore – Denver, Bureau of Reclamation, Kris Johnson – Natural Heritage of NM with contributions by Jackie Smith (Natural Heritage of NM)

SWWF Life History

- The SWWF (*Empidonax traillii extimus*) is a subspecies of the willow flycatcher. SWWF was listed as endangered in 1995.
- The breeding range of the entire species (as shown in slide 2) covers most of North America. The wintering range of the species includes Central and South America, Peru, Brazil and Boliva
- A species range map for SWWF is shown on Slide 4 of the presentation.
- The SWWF is insectivorous, eating by hawking and gleaning. Primary prey includes flies, bees, wasps, bugs, leafhoppers, and dragonflies.
- The SWWF is a late migrant. It arrives in May to mid-June and departs in mid-August to early September
- Slide 7 shows the Bureau of Reclamation's survey numbers for the MRG south of Isleta.
- San Marcial numbers include the upper pool of Elephant Butte Reservoir.
- The total number of territories and nests at Sevilleta to San Marcial increased in 2004 over 2003 by 106 to 149 nest at Sevilleta, and 111 to 185 nests at San Marcial.
- The numbers of SWWF within these areas is on the increase
- The SWWF is attracted to a forked branching structure of branching for nesting areas -
- Nests may be found within native willow/cottonwood, saltcedar, or mixed native and nonnative stands. The majority of the nests are found within native-dominant vegetation areas.
- Nesting substrate (the piece of vegetation where the nest is placed) has been surveyed to include 57% native and 38% saltcedar for the data collected from 1999-2004.
- SWWF nest extensively in saltcedar because of the structure of the branches.
- SWWF was first documented in saltcedar in the 1970's in New Mexico. The largest population of SWWF in saltcedar was documented in the 1990's at Roosevelt Lake in Arizona.
- The types of saltcedar that SWWF tend to use have a tall dense structure with a high canopy near water or saturated soils. These areas exhibit the same characteristics as preferred native type habitat
- Saltcedar is full of fine structure. In some cases saltcedar habitat could be monotypic or mixtures of native and exotic vegetation
- SWWF do not use saltcedar that is in open patches, too thin, or far from water
- Several Hypotheses were generated regarding the use of saltcedar by SWWF:
    - Saltcedar is used only when native plant structure is not available
    - If saltcedar is used, then it would provide inadequate food resources, and SWWF would suffer poor reproductive success and/or survivorship

- There have been 10 year of studies associated with these hypotheses that focus on blood chemistry, study of banding returns, tracking movements, etc. Studies found no difference and no negative effects from birds breeding in nonnative habitats verses native habitats
- There is a difference in the diet for birds breeding in nonnative habitats, but no adverse physiological effects from it.
- The conclusion is SWWF do not use all saltcedar habitats - less than 1% of saltcedar present is areas of suitable habitat has SWWF.
- Saltcedar is not bad for SWWF everywhere; there are no universal negative effects of saltcedar on SWWF.
- It is possible that in some places if saltcedar is removed, then it may reduce available suitable habitat
- The SWWF has a very close affinity to water. From data collected by Reclamation between 1999-2004:
    - Out of 435 SWWF nests - 91% of the nests were located within 100 meters of the river; 84% of the nests were located within 50 meters of water
    - In 2004 alone – Out of 174 nests 100% of the nests were located within 100 meters of water and 98% of the nests were located within 50 meters of water.
- A nest habitat quantification study indicates that the SWWF prefer nest sites that have dense patches of vegetation with high foliage volumes compared to randomly selected unoccupied sites
- SWWF also prefer taller stands of mid-canopy trees and shrubs(3-6 m)
- Willows are the preferred nest substrate in the Elephant Butte area, but are less frequently selected at upstream sites. The sample size (number of sites) for upstream areas is somewhat low, so this preliminary data may be slightly skewed. Reclamation is currently looking to obtain more information for the upstream sites.
- Reclamations is also in the process of analyzing the vegetation returns using lidar technology and is finding that SWWF are occupying the highest classes of vegetation, between 20 and 40 ft. (shown on slide 17 as red stars). This work is ongoing.

SWWF studies at the Pueblo of Isleta

- Natural Heritage of NM has monitored for SWWF for four seasons. There has been SWWF reported on the Pueblo of Isleta since 1994.
- Research has included cowbird parasitism, vegetation, and avian hosts studies
- In 2004, the Pueblo of Isleta started to do some water management for habitat improvements and it is ongoing.
- An irrigation turnout was installed to direct water from one of the drains into the nesting habitat
- Because of the high water year it is difficult to determine how much of the water is from the drain
- Isleta has a small site with about 8 territories. The site has water fluctuations and it is situated between Alejandro Wasteway and the Isleta interior drain
- Survey results of SWWF breeding is shown on slide 19. There is currently not enough data to run statistics

- However there has been a correlation between the presence of water and decrease in parasitism.
- In 2003, the nesting area was almost completely dry and there was a decrease in nests and an increase in parasitism.
- This year (2005) there has been no parasitism so far
- Six territories and five nests have been identified so far in the 2005 season. The habitats where the nests have been found have been in the classic willow/cottonwood habitat.
- In 2003 and 2004, the majority of nests were in Russian olive and the foliage volume at the nests was higher than areas in close proximity or subplots
- There have been differences in water levels this year from 2004. This year, the area is completely saturated and in some places it has been a challenge to navigate even with chest waders. The road to the area is also under water from over spill from the drain.
- The patch of habitat at the Pueblo of Isleta is not big enough to support more territories

Habitat Analysis

- The Cliff-Gila valley has the highest number of nests in New Mexico.
- Within the habitat, there is a box elder community. There are very few saltcedar and Russian olive
- The box elder has the desirable twig structure that is suitable for nesting. Close to 400 nests have been found this season alone.
- Vegetation characteristics at nests were compared statistically with vegetation characteristics at null points Vegetation types compared included
    - ACNE – Box elder
    - ELAN – Russian Olive
    - SAGO – Gooding's willow
    - SAEX – Coyote willow
    - POFR - Cottonwood
- A study compared the average nest success vs. tree species. The highest success was found in box elder.
- Parasitism was also lowest in nests found within box elders. This may be related to nest height.
- There was also a relationship between high nest success rate and nest height. So, nests in a high substrate may have an advantage
- SWWF in the Gila did not prefer willow as a nesting substrate. They preferred to nest within box elder.
- The SWWF did not do well in terms of nest success and parasitism in Russian olive. It is possible that the Russian olive may serve as a super stimulus for cowbirds.

Follow-up Discussions

How important is water for habitat?

At Isleta there was water at the time of nesting, but it is not necessary throughout the season.

The bulk of birds Reclamation is finding are where there is a consistent source of water throughout the season. The flooding does not necessarily need to be under the nest. There have been some sites that dry at the surface, but the nest is in close proximity to water. In some instances, there may be flooding present during the 1st nesting cycle and if it was a failed attempt, if would be dryer during the second cycle.

In the Gila, conditions vary from year to year. They are finding a relationship between nest location and proximity to water. Closer proximity to water leads to increased nest success. It is also related to cowbird parasitism as well.

Has anyone speculated on the apparent increasing trend in the population in this part of the bird's range and what is causing it? And how does it compare to what is happening to the range of the whole species?

Range wide there is a 10x increase from 1992. A lot of the increase is due to more surveys being conducted. Some of the increase is from local population expansion.

The increased population in San Marcial has been a topic of discussion. Some say that the increase in population is because Elephant Butte water levels have gone down and now there is an expansion of habitat, which has happened. However, within the floodplain there was a lot of suitable habitat, but there were not any birds. The birds that were there were not very successful. Over the years, there were more nest successes. The nest successes continued to a point where a definite increase could be detected

This increase in population may also be due to increased protection and restoration efforts.

In the Gila there are population fluctuations from year to year. There is a need for additional information on what is happening on the wintering grounds

Has there been any work on the wintering ground and how that might affect the populations here?

There has been a lot of work that was done in the last 6 or 7 years. The first research was in Costa Rica in the 1990's. The research has been expanded over the years. They are finding that the SWWF is widespread and that there are a lot of threats on the wintering grounds. Some of the study sites have disappeared between trips because they have been cleared. The birds seem to be using the same type of successional-stage habitat that they are using here. We do not know how much of am impact the wintering ground has on the populations, but it is known that there are threats there.

The RMRS is also finding a relationship to weather and climate. Some years are wet years, some years are dry. There may be something similar happening on the wintering grounds.

Studies have shown that survivorship is high in the winter and breeding seasons. So where are the birds taking the hit? It might be because migration is stressful. We need to be thinking beyond just breeding habitat.

What is the historical population in the Albuquerque area and what is currently being found?

SWWF's have really only been found at one site in the Albuquerque Reach. This site is called the Graham property and is located north of the oxbow on the west side of the river, across from the RGNC. They have only been found during migration. No nests have been found.

Most of the other study areas are in the upper Rio Grande, Pilar area and other tributaries of the Rio Grande up north. What we have seen is that when the water dries up the birds leave. The birds would be present during the first period of migration and then the birds leave with the water. There is a relatively good population of birds in southern Colorado in the San Luis Valley.

Have there been any studies that have been done that investigate other factors besides water and vegetation structure types that may be influencing SWWF territory formation in the Albuquerque Reach?

One thing to clarify is that only a very small portion of the Albuquerque reach is being surveyed by Hawks Aloft. Currently, there are not any surveys or studies being funded through the SSc. In 2002, a vegetation mapping study indicated that there were 20 acres of suitable, or potentially suitable, habitat in the Albuquerque reach; however, the Albuquerque reach just might be too dry. It does not receive overbanking that is sufficient to be attractive. It has the right structure, but it is too dry.

Historically, the last known potentially breeding birds (suspected territory) were detected in 1998 in the oxbow area.

Is it worth it to do habitat restoration for the SWWF in the Albuquerque reach or is it better to use the money in areas where there might be greater success?

If there is water they will come. It might be beneficial to provide some water to the suitable habitat areas.

There are other factors to consider in determining whether SWWF would settle in the Albuquerque reach like the biology of the birds, dispersal, how close are existing populations. The Isleta population is the closest population to Albuquerque. It really does take a large population to be able to see any dispersal.

Ideally, restoration efforts should be done in close proximity to existing populations. Those areas would be more likely to be occupied than those areas disjunct from existing populations.

There is some funding to the Sandia Pueblo for habitat restoration, so we may see in the next 5-10 years whether there will be some dispersal.

As part of the COE Bosque wildfire project, SWWF surveys have been conducted. They have found a number of locations where the birds do pass through.

The FWS RMRS will be submitting a paper on patch size and cowbird parasitism.

Is the affinity of the SWWF to water a function of food sources and what are the food source requirements?

There are a number of different factors; the water provides for more lush vegetation, it is cooler, greater diversity, increased humidity, more productive, increased food sources. The affinity is probably a combination of several factors.

What food types are the SWWF eating- aquatic or terrestrial- and does that play a part in the affinity to water?

Food studies indicate that the diet is highly variable. SWWF consume aquatic, terrestrial, and pollinator type insects. The diet is highly variable from year to year indicating that they are highly adaptable. They seem to eat what is there. Unfortunately, they do not eat many mosquitoes

Physical Aspects of the Middle Rio Grande

The Middle Rio Grande: Albuquerque Hydrology and Geomorphology Overview
Panel lead and Presenter: Paul Tashjian – FWS Regional Office, Panelists: Tamara Massong – Reclamation, Nic Medley - ISC, Mike Harvey - Contractor, and Mike Murphy - Contractor

Hydrograph

- The MRG has the benefit of having Cochiti Reservoir for flood control.
- The hydrograph of the Rio Grande at San Marcial is shown in slide 2. The hydrograph's general shape is intact, this is great.
- The 1997 yellow line shows the hydrograph after the construction of Cochiti's flood control reservoir. Note the different shape than the other two, which have more of a defined peak.
- The hydrograph for this year's spring runoff from May 12 to June 9 is shown in slide 3. The graph compares flows at the Otowi gage (which it more or less a natural hydrograph) to Albuquerque. The Albuquerque hydrograph could be improved to more closely mimic the Otowi hydrograph. In particular, the tail out could be optimized for the benefit of native riparian species and native fish.
- Looking at the daily flows for Albuquerque from 2000-2004, as seen on slide 4, because of reservoir and farming operation flows targeted to the Belen Division of the MRGCD, there tends to be flows of 200-900 cfs most of the time.
- Most individuals tend to focus on peaks when evaluating how to improve the hydrograph; however, although the peaks are important, the low end of the hydrograph is very important as well.
- If you look at the duration curve (as seen on slide 5) the majority of the duration of the flows are in the lower cfs ranges.
- Important alterations to the Albuquerque hydrograph include: 1) increasing the spring run-off peak so that the floodplain within the levees receive flooding during larger run-off years, 2) diversify low flow ranges to allow for the in-channel bars to diversify, 3) mange the spring run hydrograph to optimize the tail out for the benefit of native riparian species.
- Other things would be to take advantage of the infrastructure, which would tie in well with the wetted refugia concepts. For these refugia, we do not want a constant 200-300 cfs constant flow.
- A dry river or extended intermittency in all reaches would need to be factored in during any type of alteration.
- In Albuquerque, the drains and jetty jacks freeze channels to 604 ft wide. The jetty jacks line the channel and the drains are basically eliminating wetlands
- Jetty jacks also lock the channels in place. When overbanking occurs, sediment is dumped out at the river's edge and forms bankline levees. The sediment builds up and impedes flood waters from returning to the main channel. This is part of the problem that is contributing to the isolation of fish in the overbank areas.
- What is being seen at Los Lunas is largely a function of the hydrograph and low end flow diversity. The channel is starting to braid, extensive island formation

Channel and processes

- Slide 13 presents the MRG channel width verses river mile in 1992. The channel is delineated as the unvegetated active channel.
- The channel looks a lot different today than it did in 1992 because a lot of narrowing has occurred. Likewise, the channel will look a lot different today than it did last year because a lot of widening, including potentially mobilization of vegetated and unvegetated sand bars,, has occurred as a result of the high spring runoff flows.
- The general pattern of the channel is that downstream of Cochiti it is more narrow, and single threaded.
- From Bernalillo to Bernardo there are jetty jacks that line the channel producing a more consistent width.
- In the first portion of the Socorro Reach, the Rio Puerco dumps into the river making the widths much more dynamic.
- The river within the transition zone is incising, coarsening from sand to gravel and converting to a low-flow single threaded plan form.
- Many of the original bars and islands have also become isolated from the channel. This causes an isolation of habitat.
- Gigi Richard has conducted studies looking at channel width reduction in the reaches from Cochiti to Bernalillo. Additional information can be found at http://www.fws.gov/bhg.
- A study conducted by Mike Harvey on trends of grain size in the river at different reaches indicated that the majority of the northern reaches show a coarsening (increase in grain size) over time; however the grain size in the Albuquerque reach has remained fairly constant.
- This trend of increasing grain size may migrate downstream to Albuquerque and this needs to be watched for.
- The transition zone found at Bernalillo provides for a high diversity of great habitat. While the Bernalillo reach is already highly incised and may continue to incise with high flows; the transition zone has not incised fully. The bars and islands are connected; however, the side channels that used to be active at low flows are now active only at high flows. With continuing incision, the side channels would most likely be abandoned. So, the question is, *will that transition zone at Bernalillo be sustained or will it incise?*
- Slide 21 is a picture of the floodplain at Tingley Beach located within Albuquerque
- Rick Ortiz did a thesis that looked at incised channels and islands from 1971 to 1998. Additional information can be found at http://www.fws.gov/bhg.
- FWS (Paul Tashjian) has done some studies that look at the shorelines at different positions in Albuquerque at different velocities (cfs). Results indicate that the shorelines do not move – making it a homogeneous habitat.
- In contrast, in Socorro, the shorelines are complex and do move with different velocity flows-making it much more diverse habitat.
- In Los Lunas, the shoreline is straighter than Albuquerque, but the velocity profile shows diversity. This diversity is due to bars and islands that have vegetated over the past 10 years,

creating floodplain-like conditions. The diversity in the low end of the hydrograph has benefited the aquatic habitat.

- Mike Harvey is conducting a study in the MRG on different bar types within the bankline. It is important to figure out what is going on between the banklines with bars to figure out how the bars can be enhanced to create floodplain-like surfaces. The study looks at flow, type of bar, and the type of inundation, essentially tracking the bars.
- There is basically no overbanking through Albuquerque except at the mouth of the arroyos and at the oxbow.

Important trends in the Albuquerque reach of the Rio Grande to follow:

1). Will Albuquerque's channel incise further, narrow and disconnect from vegetated bars and islands (like north of Bernalillo)?
2). Will the sand bed coarsen in Albuquerque as it has north of Bernalillo?

Continuing monitoring needs

- Geomorphic
  - ° Cross sections, channel planform, bar evolution, sediment
  - ° Monitor flood-plain surfaces at various flow levels
    - Utilize ground data and remote sensing
    - Synthesize existing work of Richards, Ortiz, Hepler, Massong, Harvey to set up some monitoring protocols
- In channel habitat characteristics
  - ° The measurement of velocities and depths
- Sediment sources in Albuquerque and north
  - ° Tributary investigations – reconnecting tributaries and small arroyo mouths, studies on the Jemez reservoir and the Rio Galisteo
  - ° Opening the tributary mouths would increase the sand-size sediment into the system and would be a benefit to the system

Habitat Improvement Techniques for Albuquerque Reach

- Passive
  - ° Re-connect tributary and bank storage sediment to MRG channel
  - ° Alter Hydrograph
    - Increase spring flows
    - Diversify low flows
- Active
  - ° Increase bank mobility and complexity
    - Remove jetty jacks and Russian Olives, lower banklines, increase bankline complexity
  - ° Lower bars to reconnect to river flows at varying flows

- Cut channels in islands and bars
- Increase woody debris
- The last slide shows the Los Lunas site. A lot of the habitat formed after the design of the site. If you consider just one site in Albuquerque. One big site like the Los Luna Site could do a lot of good for the Albuquerque Reach.

Follow-up Discussion

Mike Harvey added three points about restoration in the Albuquerque reach

1) Any floodplain or any type of dynamics are located between the jetty jack lines. This is the area that is available to work with unless the jacks are removed.

2) It will be interesting to see what happens after this season of high flows, but it is suspected that there will not be much change to the bank line. The reason is that about 3 ft inland from the bank is sand and gravel and at the water's edge is a concave bank formed by lateral aggradation processes. This causes an armoring of the banks regardless of jetty jacks or riprap. The only way the banks would erode is by toe scour or undermining.

3) There is a lot of talk about creating secondary channels, but the dynamics need to be understood. Any secondary channel that is created is an ephemeral feature because at the upstream and downstream ends there is flow separation and flow expansion that causes sedimentation and the channels will plug. Maintenance would need to be done to prevent plugging.

Subflow and the coupling of surface water to the shallow groundwater system is providing the soil moisture and sustaining the vegetation and the habitat structure. When designing channels and distributing surface water flows it is important to understand how infiltration is working.

Tamara Massong indicated a main observation during her studies is that between Bernalillo and through Albuquerque to Belen, the banks are not moving at all. The vegetation has locked them in place. South of Belen into the San Acacia area, the banks are moving rapidly in many places. Most of the sediment is ending up at Elephant Butte. To do restoration in Albuquerque, the decision of restoration in the channel or out of the channel needs to be made. If out of the channel, then the jetty jacks need to be removed, remove the vegetation, or lower the banks. This would be a very costly effort. The modification of inlets within the jetty jack lines would be a good alternative.

Nic Medley indicated the main thing that needs to be done is relate physical processes to RGSM and SWWF habitats. The biggest concern is the relationship between discharge and overbank flows. This year has been a great year in terms of lots of overbank flow, great habitat, juvenile fish, and good egg retention in the Albuquerque reach. The question is how do we maintain an equilibrium channel where flows go overbank on a regular interval.

If sediment is being stored in the laterally constrained system, the only place for the sediment to go is up onto the floodplain or onto islands that are being created within the floodway. (Note: Currently, sediment is mostly on the islands, not on the floodplain. In general the system is sediment poor) The elevation of bars within the floodway increases quite a bit. So, although this year was a good year for overbanking, there may not be much overbanking in future years. The overbank flow needs to be maintained. The only way to do this is to let the river flow naturally and let the river be a river. The lateral constraints need to be removed, so sediment can be moved from the banks and through the system. Then if sediment is being stored in the system, it would be stored both as vertical and lateral accretions. Even if there was

no incision occurring in the Albuquerque Reach, the floodplain would build up in a constrained system and the river would ultimately become disconnected. This is the limiting factor and where restoration efforts should be focused.

Do you have pictures showing the aggradation? Pictures of sedimentation below the Isleta Diversion Dam have been provided by the Pueblo of Isleta.

From Los Lunas to Belen, no inundation of the floodplain was observed. The island sediments were level with the water surface at a lot of the islands within the channel.

There are a few ongoing studies that involve surveying a number of bars by the south diversion channel that might be able to help quantify how much sediment is aggradating on the islands and other surfaces.

Has there been any consideration of river nourishment and replacing whatever is deficient like sediment or sand?

The problem in terms of direct replacement is that the transport capacity of the river is very high. People are thinking about conducting studies to look at tributaries and what the potential might be to increase sediment to the system, since some are not connected, to help replenish deficiencies. Another point is that the tributary loads have also changed; most of them have decreased (i.e. the Rio Puerco), or changed their sediment size.

There is currently new island formation in the Albuquerque reach. What is the effect or dynamics of this? Would there be more flooding? How do you strike a balance between these processes?

There currently is no answer to this, primarily because the modeling that has been done uses a fixed main channel bed. So, with more vegetation and more islands, it will increase water surface; therefore you could assume more overbank flooding. There is data on sand bed systems that suggests with increased roughness, more flow would be forced into non vegetated areas and scouring would be increased.

The FLO-2D model does have mobile bed model capabilities, but it is not calibrated. The COE is currently working on the appropriate sediment equation to be used to predict sediment transport in the Albuquerque Reach. For habitat restoration purposes, it has been recommended that the grid size be reduced from 500 ft for accurate modeling. Once a proper equation is determined, this model should be calibrated using the overbank flooding data collected from this year; however, the calibration of the model has not yet been funded.

Downstream of Los Lunas, the channel is braided and the active channel width hasn't changed. There are lots of islands splitting the flow, even at low flows. A single channel would only have a higher flow velocity if the flow path is shorter than it was when it was braided. (Note: this reach is not expected to convert to a single channel in the near future.)

Southwestern Willow Flycatcher Suggested Specific Habitat Features (handout)
Panel lead: William DeRagon– U.S. Army Corps of Engineers, Panelists: Art Coykendal– U.S. Bureau of Reclamation, Brian Bader– Pueblo of Santa Ana, Dave Morgan– Ohkay Owingue, Deb Callahan– U.S. Bureau of Reclamation, with contributions from Gina DelloRusso– Bosque del Apache NWR

Migration Habitat

- A variety of habitats are used by SWWF during migration. There is some preference for proximity to water and dense shrubs, both native and non-native.
- There has been an extensive (~1,700 acres) loss of shrub communities due to fire, and clearing for fire risk reduction and habitat restoration in the Albuquerque Reach. Improvements are required. The "standard" Bosque restoration concepts would apply.

Breeding Habitat

Albuquerque Reach conditions include:

- Approximately 20 acres of potentially suitable or suitable breeding habitat (in 9 small stands). The stands are located primarily on point bars.
- There is very little overbank flooding even during 6,500 cfs flow, as seen in May 2005.
- In general, Bosque soils are too dry to be suitable.
- Small source population SWWF at Isleta Pueblo.

Absolute breeding requirements include:

- A proximity to water throughout growing season- approximately 150 to 300 feet.
- Albuquerque Reach sites will need to be made wetter. This can be done by adding water and removing soil to increase overbanking potential

Water

- High-flow channels with target flows of 2,500 – 4,000 cfs for utilizing water for habitat
- Artificial inundation in lieu of overbank flooding
    - Irrigation return flows
    - Sustained upland runoff – storm water discharges, treated effluent, for the establishment of stands on floodplain
    - Groundwater pumping
- Bank or point bar lowering to achieve inundation. One example is the Albuquerque Overbank Project (A.O. P.)

Bosque del Apache NWR:

- An important advantage of sites that can be flooded is natural germination (opposed to hand planting).
    - Initial flooding can germinate weeds in seed bank. This can cause competition with woody plants in the first year of establishment. If it too big a problem, the weeds can be disked to remove.
    - If this is the case, the next year's flooding can produce a greater percentage of cottonwood and willow during seed germination.
    - The next year's flooding can provide additional seed set at a lower topographic level, or flush salts.
    - Periodic maintenance flooding may be required.
- Resultant stands (vs. planted stands):
    - Higher stem densities
    - Greater species richness
    - Distributed in natural mosaic
    - Cost effective

Pueblo of Santa Ana:

- Groundwater swales (wetland willow swales)
    - 5 foot excavation
    - Coyote willow stem cuttings planted in trenches to the water table
    - Water table at surface when river is bank full; otherwise 2 – 3 ft below surface
    - Slow growth during last few dry years . . . sand-&-gravel substrate.

- Backwater planting (or Swales on immediate river bank)
    - Better success closer to river.
    - Growing season water table at 1 – 2 feet below surface.
    - Gooding's and coyote willow stems in trenches. Planting using the trench method allows for an interlocking structure.
    - Fast response with Gooding's willow stems (not poles). Stems have lower mortality rate (<1%) compared to pole plantings (60%)
    - High water tables can retard initial root development.
    - Selection of planting stock is crucial. For coyote willow planting's, the greatest success occur with straight ¾-inch to 1-inch diameter stems at the root crown.

Ohkay Owingue:

- Trying to expand occupied habitat.
- Coyote willow plugs. Roots crowns were planted after trimming the tops with 90% survival rate. They can be planted almost any time of year. The issue with poles is that if they are planted in the winter and then are flooded in the spring, they do not do as well as those that have roots established.
- Concerns to be monitored:
    - SWWF movement away from stand.
    - Senescence of willow stands. There needs to be a wide range of vegetation age groups. Adequate geomorphologic disturbance is needed for maintaining habitat. Pole planting cannot be a substitute.

Questions and Concerns

- Patch size.
    - In general, build the habitat as big as possible. The Biological Opinion say 60 acres for restoration. This estimate was based largely on SWWF populations on the Pueblo of Isleta and the "condo" site at San Marcial. There have also been isolated occurrences of SWWF breeding pairs in small stands.
- Surrounding plant community.
    - The area adjacent to where the habitat is constructed is very important. If the site is adjacent to marsh, or open water habitat, this would be beneficial. Riparian woodland is better than an upland terrestrial area.
- Life expectancy
    - The life expectancy of the restoration effort is a key consideration for long-term success.
- Monitoring.
    - Monitoring should be conducted for all projects to assess the success of plantings and animal use.
- It is important to consider, when you are building SWWF habitat, you are also building wetlands. Hydrology is a key factor

Follow Up Discussion

- There is no "cookbook" or formula for creating habitat and attracting SWWF. There is still a lot to learn about what it takes to create SWWF habitat. Generalizations about vegetation structure and the role of water can be made, but there may be some things that have not even been considered.
- At Elephant Butte Reservoir, there are over 1000 acres of optimal habitat that are not occupied. Other factors, such as population dynamics may play a role as to why.
- In an area along the Gila River in the Red Rock area grazing was eliminated, willows became established and then SWWF were found. Habitat restoration needs to be tailored to a specific site.

- It is important that habitat restoration successes are exchanged, so others know how it was accomplished
- Another option for habitat is purchasing or converting existing farm fields where there is infrastructure for irrigation. This would allow for more control and a very heavily managed process for creating habitat. This is one of the reasons the refuge is so ideal.
- There are other opportunities along the MRG through land trusts or conservation easements for creating larger areas of SWWF habitat.
- For several years the City of Albuquerque was considering using the water from the WWTP to create wetland for SWWF-type habitat. It eventually became mute because of nitrogen removal issues.
- Another source of water is irrigation drainage returns, as Isleta Pueblo is currently doing. Sevilleta is also doing a similar project. From surveys on the San Juan Pueblo, SWWF have been found within small patches of willows associated with a waste way or outfall.
- Stormwater could also be utilized. There are some water quality concerns with stormwater runoff. There needs to additional continuing investigation throughout the southwest on the impact of water quality on species.
- In general, the standard water quality improves fairly quickly. The limiting factor in many effluent dependant water courses is habitat structure. A lot of the times the end of the pipe is not designed to be habitat, it is designed to be a dumping or a mixing zone to accommodate certain features of water quality regulations.
- Bosque del Apache (BDA) has done a great job at restoring riparian Bosque habitat, and this may be useful for SWFF habitat; but, current data does not support that the SWWF are increasingly attracted to this riparian habitat.
- Good SWWF habitat requires a particular configuration of vegetation structure in various stages. This kind of configuration could be developed in an agricultural setting.
- One thing that needs to be considered is sustainability within the natural system.
- From a project management standpoint, information regarding the stand structure, stem density, height of interlock, variation of stem density over time that can be made readily available would be of great use.
- Looking at SWWF habitat from a reach level or landscape level is in line with the Recovery Team thinking. Looking at a larger reach or a matrix of sites in different stages is important because portions of the habitat will grow too large, senesce, or burn.

Rio Grande Silvery Minnow Suggested Specific Habitat Features
Panel lead and presenter: Mickey Porter, Panelists: Jason Remshard, Mark Horner, Nic Medley

Restoring habitat diversity is an important emphasis in habitat restoration for RGSM.

Focus areas of study

1) Availability of nursery habitat should be emphasized. The best habitat or food supply is secondary, if fish are not recruited to the population. The goal of every fish biologist is to produce more fish.

2) Food production. Food production also correlates well with nursery habitat features (i.e., slower water, shallower areas grow more algae and accumulate more organic materials).

3) Topography manipulation for the SWWF can also tie into RGSM habitat. SWWF and RGSM habitat restoration can be done at the same site.

Los Lunas Restoration Project

- One of the conclusions from the project is -if you build it they will come. The green symbols on Slide 3 show where RGSM were found in February 2005 by electro fishing.
- Until November of last year the Los Lunas site was dry. So, within 4 months, 30+ minnows occupied the site. The habitat where many RGSM were located was within an ephemeral channel with water in the winter. This area is a low velocity refugia from the main channel.
- The tan symbols on Slide 3 represent where gellan bead release studies were conducted. A couple million gellan beads were added to the river upstream to see where they would settle at the Los Lunas Restoration site to evaluate the potential for egg retention if the site would act as a nursery area.
- Scheduled adaptive management activities at the site include an evaluation of how well the site retain RGSM at higher flows than what it was designed for. Perpendicular berms may be added to help slow the water along the outside berm to provide nursery areas.

Habitat Monitoring

- There are several studies being conducted on the river to assess habitat use requirements and availability for the RGSM.
    - The FWS is conducting a study on habitat use by sub adults and adult RGSM.
    - Reclamation is conducting several studies related to nursery habitat.
    - The USACE is conducting an overbank inundation study during the high flows, which will help to better understand minnow habitat.
- Slide 4 shows an area where electro-fishing was conducted in August and September 2004. At the time of electro-fishing, approximately 10,000 RGSM had been augmented into the river by the FWS approximately 1 mile upstream.
- Lines shown on Slide 4 represent areas of electro-fishing and Blue symbols show where RGSM where collected.
- During electro-fishing, more RGSM were found adjacent to vertical structures. Along the island (shown on Slide 4) in a channel approximately 3-feet deep, minnows where grouped together.

- Upstream near Bernalillo, a number of RGSM where found along the edge of an incised channel approximately 1-2 ft from the bank.
- The vertical edges produce velocity gradients where RGSM can get out of the main-channel current velocities.
- It is difficult to assess whether monitoring at a restoration site is sufficient. Currently, monitoring for presence/absence of RGSM is being conducted on restoration sites. There is still much to learn about what habitat features the minnow likes or what other monitoring should be conducted.
- In general, for nursery habit areas, low velocity areas are needed. Data suggest that if given the opportunity, RGSM will get onto the floodplain to spawn.

Habitat Criteria

- The two biggest features for construction of a restoration project for the RGSM at the minimum are:
  - The development of overbank areas that function at a variety of flows
  - Development of side channels for use as winter habitat. There is a lot of work to be done to determine whether side channels are a true RGSM habitat preference.
- If the main features are constructed, then the biological and ecological (food sources etc.) features would develop passively by the river acting on the surfaces.
- Constructing overbank areas to develop shallow water surfaces in a restoration project may help to improve food resources for the RGSM. There is still a lot that needs to be learned.

Point bar modifications

- An upcoming research project on point bar modifications will be conducted directly south of I-40 (as seen on Slide 8).
- The project will involve excavation of ephemeral channels, creating shelf areas with adjacent inlets, berm formation, and a number of areas that have a diversity of depth and flow velocities.
- The goal of the project is to have surfaces that are inundated from 500 cfs to 6,000 cfs.
- The idea of shelf topography has been developed based on observations of arroyo fans that develop into the main channel, become inundated and scoured away by base flows, developing a sharp edge (as shown on Slide 9). The shelf will be designed as water levels rise, an edge habitat will be formed where eggs and large can be contained for a few days. An inlet to a refugia will be constructed as a grow out area. The vertical scale of the diagram on Slide 9 is approximately 1-2 ft and the horizontal scale is approximately 20-50 ft.

Habitat Restoration Techniques

- Island destabilization. Destabilization for inundation purposes can be achieved by lowering the elevation of the bar and sediment removal. Then shoreline extension can be achieved.
- Woody debris piles. The woody debris provides refuge from high flow velocities. It is not fully understood whether the debris also provides substrate for food supply.
- In-channel refugia. These are small pools that would hold water when the river becomes intermittent and provide suitable habitat until flow levels rise.

- These three features can be generally incorporated into many projects. There is a lot of variability and adaptability in achieving inundation. Inundation is beneficial to both RGSM and riparian habitat
- One habitat restoration technique that would most benefit the RGSM in the Albuquerque reach is to identify features to be inundated and design features to become inundated at a variety of flows. These do not need to be large areas. A 0.1 acre could be beneficial.
- The best restoration approaches to be used to help prevent extinction would be to provide good habitat for spawning and early life stages. This includes areas for recruitment, i.e., areas to allow eggs to hatch into larvae, and areas to allow larvae to grow to juveniles.

Program Long Term Plan

- There are several factors to be considered for the prioritization of reaches for RGSM restoration projects. These includes the following:
  - Reaches that have permanent flow in dry years
  - Reaches that have core subpopulations. Currently, there are populations below Isleta and San Acacia Dams and at Rio Rancho.
  - Augmentation. Augmentation needs to be scheduled near constructed projects.

Follow Up Discussion

What are some passive restoration techniques, like altering the hydrograph and looking for sediment and other factors that may encourage the river to provide some of the desirable features itself?

Passive and active restoration techniques are not exclusive of each other. Currently, a lot of the effort is focused on increased populations for the short term. Once this is achieved, then passive manipulations can be worked out to improve the system.

- Studies need to be conducted and used as the fundamental basis for design. A challenge is to have enough minnows within an area to see if there are preferences.
- We may not ever be able to destabilize the river to a great enough degree to allow it to "be a river". The river as it is today is defined as being located within the 600 ft area. This is the area that should be studied to see how it works and relates to habitat use. This is basically what the Los Lunas project is doing, but it is being done without a template. The template is out there to be studied and correlated to biological needs and uses.
- The study approach at Los Lunas was to first study the fish, since there are so few, and then the geomorphology and river channel.
- In the Albuquerque reach, enough restoration has occurred where the bank lines have been cleared of Russian olive. There is real potential to combine jetty jack removal with some other techniques to create suitable habitat. This can be cost effective.
- Active restoration is used more to encourage ecological processes to resume. [When looking at the river there is a disruption (i.e., sediment supply etc.) to ecological processes] It is better to understand the river system as a whole and what ecological processes drive the river system. This would benefit not only our understanding of the RGSM-habitat relationship, but also other processes as well.

- One thing that could be looked at as a way to prioritize active restoration is geomorphology (i.e., high incision, low incision, and aggradation). Active restoration should be targeted in areas where there are greater levels of incision.

What do you do with the sediment that is produced with some restoration projects? Can it be returned the river or does in need to be hauled off and disposed of?

- Some ways to return it to the river are being looked at. Also, if the channel is being expanded during the project, the sediment can be used to reinforce the levees. This also provides assurance to residents outside the levees that extra measures to protect homes and farmlands were performed.
- At Santa Ana Pueblo during the gradient reduction facility (GRF) project, sediments were stock piled along the side of the river. These stock piles are starting to mobilize and the river is expanding in an unanticipated manner. As sediment gets put back in, sediment plugs could form or the sediment may benefit to nutrient dynamics downstream. Additional studies need to be performed on how the river may respond as sediments are added. This topic could be emphasized in a future forum, gathering the regulatory branch of the USACE, New Mexico Environment Department, with Habitat Restoration Subcommittee members.
- The removal of jetty jacks is a good start; however given the density of vegetation in the Albuquerque Reach on the floodplain, it is unlikely that just jetty jack removal would make a difference. There is not significant erosion at locations where the jetty jacks have been flanked by riparian growth, adding root reinforcement. Some studies on hill slopes regarding root strength indicates there is a period where roots continue to be strong after vegetation is cleared before subsequently decaying. The studies may not apply near the river because resprouting occurs from the roots after vegetation has been cleared. Therefore, to get lateral movement within these areas, the roots likely will need to be removed.
- Regulations that require replanting using a specific percent of native vegetation that is proportional to the amount of native vegetation removed adds costs to the project.
- One approach to restoration would be to remove jetty jacks and shave down the banks in areas where the vegetation has already been thinned since many times Russian olives colonize directly behind the jetty jacks. Such a combination of restoration treatments should add additional bank complexity and connected surfaces.
- There are diverse opportunities within the floodway to create vertical bank lines by removing the first 10-15 feet of vegetation that is stabilizing the bank. Within the floodway are attached bars that are anchored by the stable vegetation, removing this vegetation may allow for bar movement within the floodway. This approach would need to be weighed against the potential that the attached bars provide valuable RGSM habitat.
- The river does not have the ability to cut through the mature cottonwoods growing on the floodplain; it does not even have the ability to cut through stands of immature vegetation on the islands. Islands are very stable. Historically, the river moved around them. The system needs a good kick to get going again. It is an expensive kick, even if you are just working within the 600 ft.

Presentation on Albuquerque Reach Specific Plan
Panel leads: Matt Schmader – City of Albuquerque and Kathy Dickinson - Reclamation, Panelists: Nancy Baczek - FWS, Gina DelloRusso - FWS, Cody Walker – Pueblo of Isleta, Julie Hall - COE, Peter Wilkinson - ISC, Randy Floyd – NMDGF, and Joe Jojola - BIA. All from the Habitat Restoration Subcommittee of the MRGESACP

- The area that will be covered by the Albuquerque Reach Specific Plan extends from the Angostura Diversion Dam to southern boundary Pueblo of Isleta. This is somewhat different from the traditional definition of the Albuquerque reach because the Pueblo of Isleta wanted to participate in the planning effort, but did not want to have their lands split between two reaches. The Pueblos in this reach will be invited to participate in the planning effort.
- The contractor that has been contracted to prepare the plan is the Museum of Northern Arizona (MNA) Environmental Solutions, Inc. The completion of the plan has been requested by September 30, 2005. The HRS would like to use the plan recommendations to create focused requests for proposals (RFPs) for FY 2006 for construction and monitoring projects.
- The Albuquerque Reach Specific Plan, a step-down plan from the Middle Rio Grande Habitat Restoration Plan, will contain specific information and recommended projects for this reach. The overarching plan can be assessed on the Program's website at http://mrgesacp.fws.gov.
- The scope of work for the plan was prepared by the Habitat Restoration Subcommittee over the past couple of years. The focus of the plan will be on aquatic and bankline habitat restoration projects, river/floodplain connection improvement. Ideally, the projects would include projects that improve habitat for both species, focusing on RGSM short term and long term benefits
- The goals of the plan include the following:
    - Provide a description of the physical and biological environment for the Albuquerque Reach
    - Identify and analyze existing data
    - Identify data gaps within existing data
    - Assess current habitat availability and conditions for the RGSM and the SWWF
    - Identify habitat needs
    - Identify opportunities and constraints for habitat restoration projects in the reach
- The anticipated outcome of the plan is that it will provide monitoring needs, adaptive management process strategies and information about the most appropriate restoration techniques for the Albuquerque Reach.
- Slide 9 is an example of a product from the Socorro Reach Specific Plan. For the Albuquerque Reach Specific Plan, GIS based information will include:
    - Hydrologic connection between river and floodplain (modeling flows)
    - Vegetation classes
    - Topographic features, sand bar locations
    - Land ownership
    - Existing and planned projects (Program and others)
    - Groundwater/surface water connection, water delivery infrastructure

Wrap Up Discussion

Physical Aspects of the Middle Rio Grande

- One of the good things that came out of today is the mention of specific data gaps. This is important information that needs tracking. As additional data gaps are identified, it is important to keep each other informed as to what they are.
- A map of the bars located within the Albuquerque reach needs to be compiled – some have done work on this already. It is very important to understand the different bar types and come up with techniques that are specific to each bar type that would enhance the type of habitats we are interested in.
- The Save Our Bosque Task Force has been considering a sandbar monitoring program.
- BDA is finishing mapping the bars on the refuge.
- If river bars will be manipulated in the future as part of restoration efforts, a map of river bars will need to be created. Then, specific priorities in accordance with specific goals and monitoring over time will also need to be conducted.
- Mike Harvey currently has a Program project with 10 geomorphology sites from Pena Blanca to San Marcial. He has found through modeling that the classification of the bar types appropriate for restoration and holds throughout the study area. With a river that has changed so much over time it requires care in applying a "cookbook approach" to it, in particular to transitioning from a bar to a terrace unless there is a good hydrologic model. The bar classification addresses the variability from gravel beds at Pena Blanca to the highly aggraded sandy areas in San Marcial. The field work is completed. Currently, the modeling is being verified with high flow data from this season.
- We currently do not have a useful mobile boundary sediment transport model. In previous studies using a fixed bed model, it was found that, when attempting to inundate specific areas, the sediment bed adjusted and a lot of the area did not become inundated. A mobile boundary sediment model would allow for a better handle on the vertical adjustments.
- Much of the sediment that is transported in the system is a function of the flow. It is not a liner relationship: more flow moves more sand. The implication of this is the need to understand how the channel responds to the relationship. During high flows there is a different cross-section geometry compared to low flows and there are periods when it will switch, especially during recession. Higher flows tend to create more of a channelized system and this keeps the transport rate high.
- With respect to grain size distributions, the data suggest that there is a coarsening upstream. There may be some coarsening in the Albuquerque area. The D_{50} seems to have increased a fraction, but it is still in the sand-sized range.
- We need to evaluate what the consequences of increased island formation in the Albuquerque Reach are. The islands that have formed in the Albuquerque reach are very stable. It is also important to understand the genesis of these islands. Removing the islands may eliminate RGSM habitat. Islands provide a lot of the habitat that can be targeted for restoration. In terms of hydraulic diversity, islands provide a lot of hydrologic variability in the channel.
- The highest islands (#2 islands in Harvey's classification) that have larger vegetation would be the best candidates to perform restoration. Islands should not be eliminated because they create good habitat.

- These #2 islands could be easily selected by using Reclamation's vegetation survey information and field verification.
- Both riparian and wetland river systems are in a constant state of flux. They are dynamic, establishing new habitat where habitat was not previously and vice versa. This allows for a lot more habitat diversity within the system than when it becomes static. Some of the islands need to be changed. If the river is kept with 600 feet without removing jetty jacks, then fluxuation and rejuvenation needs to be reintroduced periodically in different sections of the river in order to maximize the type of available habitat. This means finding the right balance of active and passive restoration techniques.

RGSM Life History, Aquatic Environment, and Suggested Specific Habitat Features

- Based on the work that is being conducted in the Albuquerque reach this year, the areas with the most inundated surfaces are islands, followed by bars, then the riverbank terrace.
- A lot of RGSM data will be collected concurrently with the development of the Albuquerque Reach-Specific Plan.
- Investigations of islands are an area where additional efforts could be focused to help sort out some of the details of what is happening with the islands.
- There have been some swimming and behavior studies done for the San Acacia Fish Passage project. There studies were lab based with a variety of flow velocities. The results of the study indicate that the fish does not like a lot of turbulence; therefore they do not like Deneil-type fish passages or single vertical slot fish passage ways. Reclamation's Albuquerque Technical Services Division has developed a natural-like bypass channel conceptual design. There are also a number of Native American cultural resources along the east bank of the MRG at the San Acacia Diversion Dam bypass. The consultation has not been completed, but it is anticipated that the designed bypass channel will not be able to be built as designed. Reclamation has a couple of proposals that were submitted to the Program to look at other alternatives like a dual vertical slot fish passage and others.
- If the natural bypass is moved to the west side of the river, then railroad tracks, a road, the Low Flow Conveyance Channel, and the Socorro Main Canal must be dealt with. Access roads would also be a problem. So, alternative solutions located in the channel is what will be evaluated next.
- The USACE has put in a proposal for FY05 funding to look at diversion alternatives at the Isleta Diversion Dam. Some operational changes may be all that is needed.
- We know that the RGSM are great swimmers. What we do not know is how far, when, or what percent of the population are moving. If they move upstream during the winter, then the existing fish passage at Isleta is all that may be needed. If they move in July, then an additional bypass structure may be needed.
- Some information indicates RGSM movement occurs in late summer or early fall. Over the past couple of years monitoring below Angostura Dam has indicated influxes of fish during the late summer/early fall. It is possible that there are RGSM above Angostura Dam; but, there is not enough data to know the number of fish– they may be coming from downstream and if so it is not known how far downstream they are coming from.
- The data available are not sufficient to make definite conclusions about RGSM movement.
- Regardless of how fish move, there should be habitat throughout the reaches available at any time of the year.

SWWF Life History, Riparian Environment, and Suggested Specific Habitat Features

- The SWWF Recovery Plan did not focus on islands for management and recovery. It emphasized that local specialists would be responsible to collaborate on a particular reach to figure out what works best. From discussions, focusing on islands for the Albuquerque Reach sounds like a viable option; however the sense is these islands are small, and not adequate for habitat. Available data suggests that a typical SWWF territory is about 1 hectare and adjacent vegetation communities (up to 4.5 hectare) may also influence territory location.
- There have been SWWF surveys conducted on islands, but there has not been any research to help guide management of islands for recovery efforts.
- From one year of monitoring at the Elephant Butte willow swale harvest site, there was great regrowth from the willow stumps. There was little visual difference between the clear cut plot, selected harvest plot, and control plots. About 2,600 Gooding's Willows were harvested for restoration activities upstream. This area was selected as a harvest area because it was far enough from surface water to not be desirable to the SWWF. Utilizing the reservoir area for harvest sites, while maintaining some reservoir areas for habitat, may be a feasible approach to obtain the necessary plant material for upstream restoration activities. The reservoir was filling again earlier this year.
- The availability of plant material for restoration needs is a concern. Coyote willow has also been harvested at the Low Flow Conveyance Channel at Socorro for a number of years. At this area. a 3-4 year growing cycle can supply a lot of willow stems. This could be combined with a couple of other sites throughout the valley to promote genetic diversity in the plantings.
- The lack of available plant material could cause logistical problems. There are thousands of plants units that will be needed for restoration. Available nursery stock will not be adequate. We will need native areas to select from and additional grow out areas should be established.

Albuquerque Reach-Specific Plan

- There needs to be an effort for government to government consultations with each of the three Pueblos in the Albuquerque Reach to discuss participation and contributions to the Albuquerque Reach-Specific Plan.
- The HRS did attend one of the tribal subcommittee meetings a few years ago and discussed the importance of the Program preparing a reach-specific plans. The HRS also approached MRG Pueblos to offer funding for habitat planning in 2005. Two Pueblos were funded for this work. It is agreed that if a Pueblo was not interested in participating, then the areas of Isleta, Sandia, Santa Ana, and San Felipe Pueblos would not be included in the Albuquerque Reach-Specific Plan. Isleta Pueblo had expressed interest and their lands will be included in the plan. The Program has separately funded Isleta, Sandia, Santa Ana, and San Felipe Pueblos for either project specific or more general planning efforts.
- No data on Pueblo lands will be included in the Albuquerque Reach-Specific Plan without the Pueblo's consent.

Data Gaps and Research Needs Identified During Forum Discussions

- A mobile boundary sediment transport model for the Albuquerque Reach is needed.
- A study of current sediment sources for the Albuquerque reach is needed.
- A catalog of plant material sources is needed.
- Studies to classify types of islands and bars and determine the roles they play as well as identify the appropriate techniques to enhance each bar type and priorities for each enhancement are needed.
- Fish movement studies are needed to be able to answer the following:
    - Are fish found at the base of dams because they want to move upstream or because that's where it's wet?
    - Do RGSM stay where they are augmented because there is good habitat or because they do not move far?
- Studies relating to the relationships of predation and competition for habitat with RGSM are needed.
- Other factors (i.e., lack of water and over banking, population, SWWF dispersal, patch size) that may influence the absence of SWWF nests in the Albuquerque Reach need to be studied.
- There has not been any research to help guide management of islands for SWWF recovery efforts.